

Note accompanying Two Charts showing the Proper Motions of all the Stars in the Catalogues of Proper Motions by the Rev. R. Main and Mr. Stone. By R. A. Proctor, B.A., Cambridge.

I have the pleasure of presenting to the Society two charts of proper motions, showing in a graphic manner the amount and direction of the motion of every star whose place in R.A. and N.P.D. was determined by Bradley, and has since been compared by Messrs. Main and Stone with the catalogues of the Greenwich Observatory. The motions are indicated by arrows attached to each star, the direction of the arrow showing the direction of the star's motion, while the length of the arrow shows the amount by which the star would move (according to the catalogues) in a period of 36,000 years. This is at least the case in all instances where the proper motion is not very great in amount; and in *every* case the length of the arrows shows the relative rate of the star motion. But as it was convenient to use the stereographic projection, in which the variation of scale is great, the arrows indicating very rapid proper motions have a length depending partly on the star's position in the projection, and the extremity of the arrow does not in these cases mark the place of the star at the end of 36,000 years. In fact, assuming a star to move for that time on a course appreciably straight, the projection of its path on the heavens would belong to a great circle, and in order that it should be correctly indicated the arrow should be curved in the projection. I have not thought it necessary, however, to attend to this consideration, which would introduce some confusion into the map, while the present arrangement as explained cannot possibly be misunderstood.

The maps show also the estimated position of the apex of the solar way according to the researches of Sir W. Herschel, O. Struve, Argelander, Mädler, the Astronomer Royal, and others. Arrows have been placed over all parts of both maps, corresponding in length and direction to the estimated apparent motion of a star of the first magnitude, supposed to be at rest, but changing in apparent position on account of our Sun's motion. Thus it becomes possible to determine at once whether a star or set of stars in any region be moving, or not, in a way corresponding (in direction or rate) with the effects due to the Sun's motion.*

Observations of the Solar Prominences. By Capt. Tupman.

In order to view the hydrogen prominences on the limb of the Sun, it has generally been thought necessary to employ a somewhat large telescope fitted with a spectroscope of great dispersion.

* Owing to the pressure of other matter, I defer the full description and discussion of the two maps. A companion paper on Star-guaging is also deferred to next month.

To show that this is a mistaken idea, I have brought for your inspection the small instrument with which the observations detailed below were made. The telescope is a common one of 3 inches aperture, with an indifferent object-glass of 40 inches focal length. The spectroscope, by Mr. Browning, is a direct vision of five prisms, producing a dispersion very little greater than that of an ordinary flint prism of 60° . There is a small tube carrying the slit and achromatic collimating lens, and a small telescope for examining and magnifying the spectrum, the whole being attached to the telescope by means of a screw adapter. The entire cost of the combination, including the pillar and claw-stand, was 18*l.*; and I have no doubt that an equally effective instrument could be made for much less.

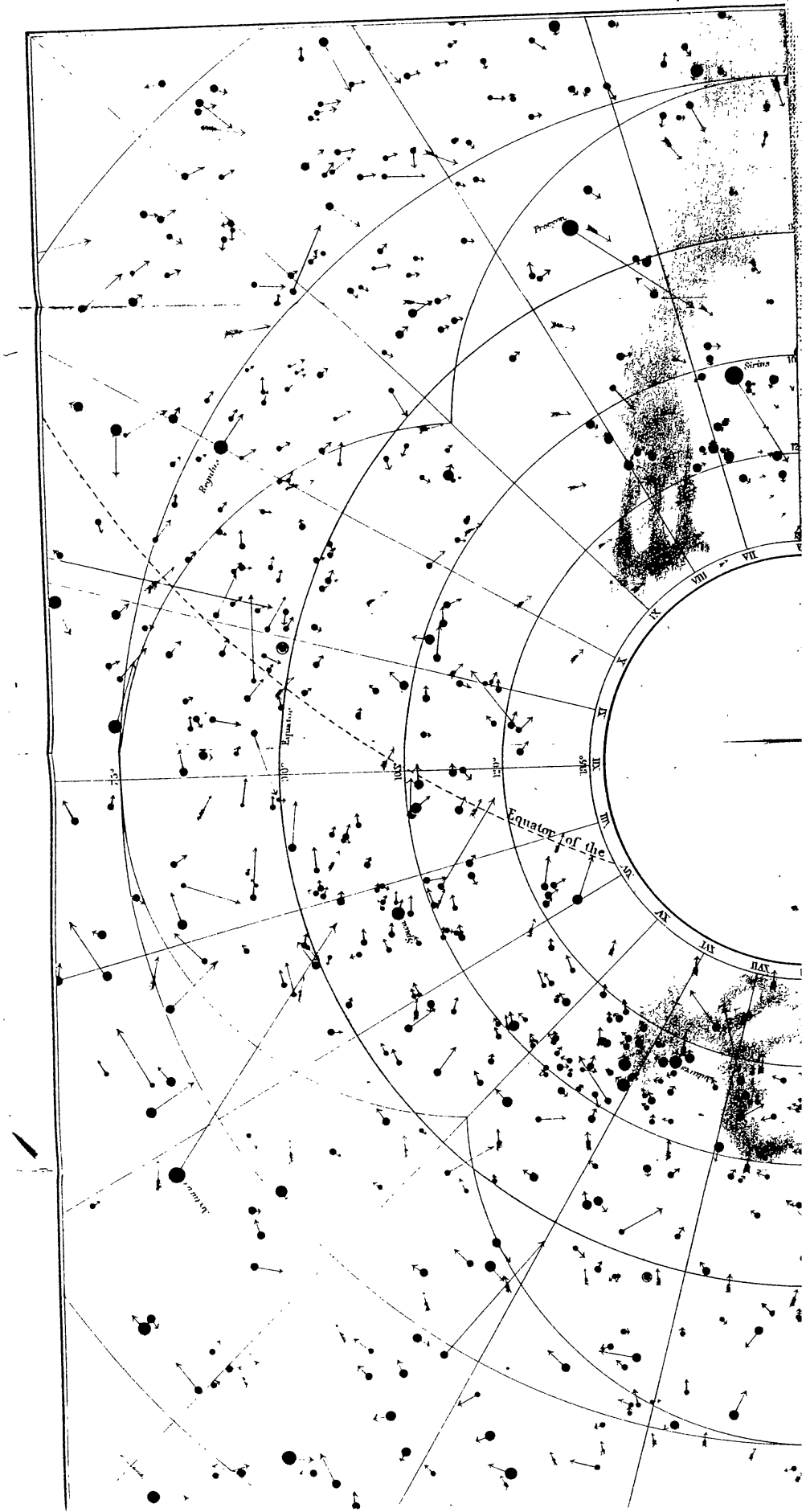
The adjustments are very simple. The small telescope is first focussed for celestial objects and marked. The slit is then adjusted, by means of the sliding-tube, so that its edges are perpendicular to the plane of dispersion, and exactly in focus of the small telescope. The latter is best done by focussing on the lines of the solar spectrum with a very fine opening. The slit is then opened to $\cdot 002$ or $\cdot 003$ of an inch, moved laterally, until the C line is approximately in the middle of the field, and the spectroscope attached to telescope so that the slit is in the principal focus of the object-glass.

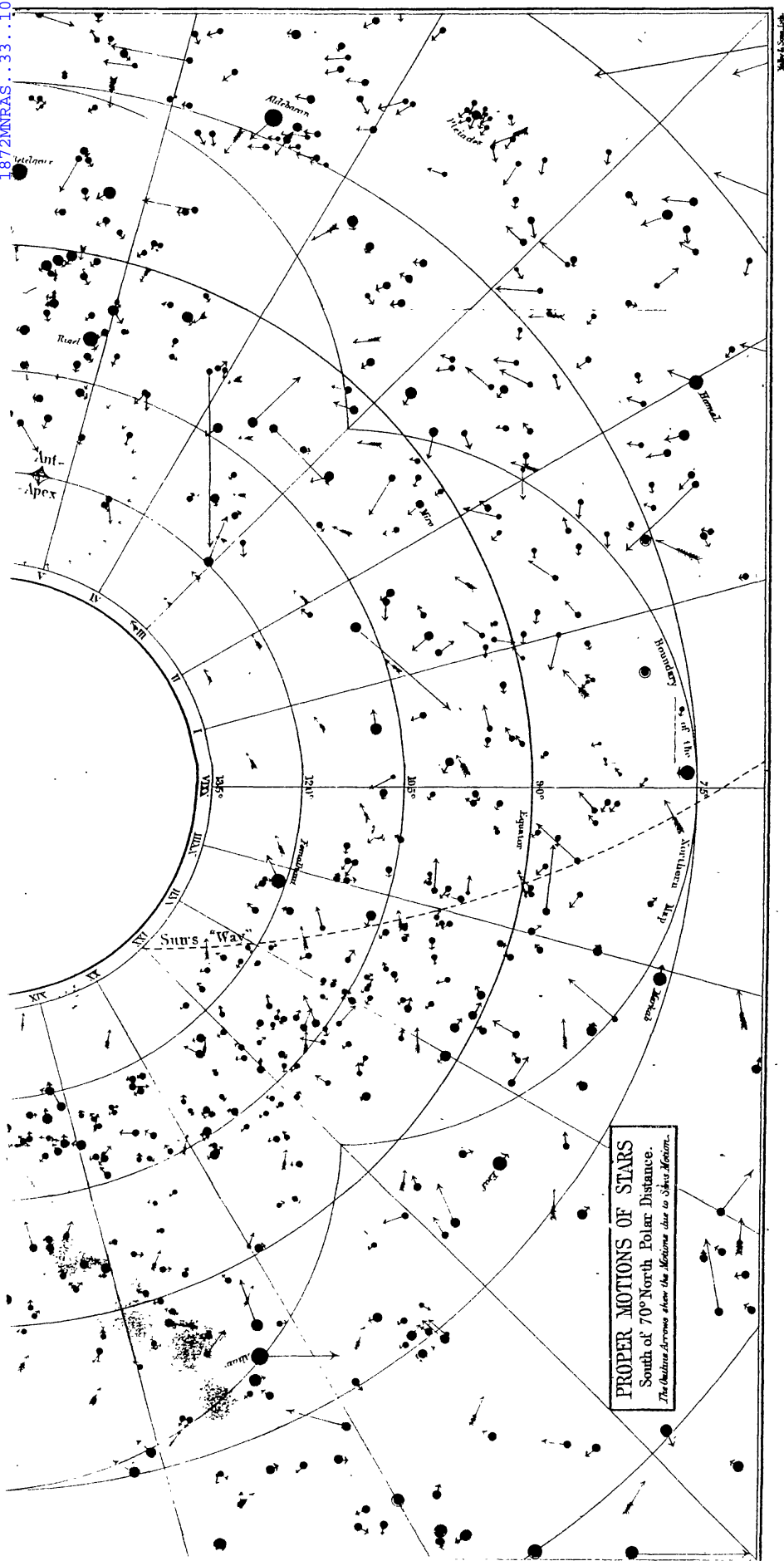
If the instrument be mounted in this simple manner,* the observer must rest both elbows securely upon the table in order to keep the limb of the Sun precisely on the centre of the slit. A little practice is all that is necessary. The red line due to hydrogen produces a monochromatic image of the chromosphere which partly fills up the dark C line, and, if all the focussing is good, the little tongues that cover the outer surface—especially near the equatorial regions—can be distinctly seen with this instrument. To examine different parts of the limb the spectroscope is rotated, and the slit used tangentially. The angle of rotation is measured on a divided circle attached to the telescope by a small pointer fixed on the spectroscope.

To save the eye from the glare when the full sunlight passes occasionally through the prisms, a diaphragm is placed in the focus of the eye-lens, so that all the spectrum is cut off except a little on either side of the C line. This answers perfectly. A little scale might, with advantage, be added, so as to measure approximately the length of the portion of the limb occupied by a prominence.

The zero of the position-circle may be obtained by turning the slit until the rotation of the Earth causes a prominence to travel evenly along it. Owing, however, to the want of stability in the mounting, I prefer to measure the position of the prominences from the vertex of the disk, the zero being determined by placing the slit several times horizontal and vertical by estimation.

* Viz. on a pillar-and-claw stand.





The height of a prominence above the upper surface of the chromosphere may be measured by opening or closing the slit until it just contains the prominence. The value of a revolution of the micrometer-screw for opening the slit may be found accurately by actual measurement, and turned into seconds of arc, for the radius equal to the focal length of the object-glass, by simple proportion. A focal length of 100 inches requires the slit to be open to 0.0485 inches to subtend 100 seconds of arc.

A quicker way, and quite as accurate, is to turn the spectro-scope round until the top of the prominence and some other part of the surface of the chromosphere enter the field together. The angle through which the spectroscope is turned will give the perpendicular height of the prominence as in the following table, which is sufficiently accurate all the year round.

Angle.	Height.	Angle.	Height.	ngle.	Height.
0	"	0	"	0	"
10	15	22	77	34	199
11	19	23	84	35	212
12	22	24	92	36	228
13	26	25	99	37	244
14	30	26	109	38	261
15	34	27	119	39	277
16	39	28	129	40	293
17	45	29	139	41	312
18	51	30	149	42	333
19	56	31	161	43	355
20	62	32	174	44	379
21	69	33	187	45	404

Professor Respighi has seen bright prominences upwards of 6 minutes high. As yet I have only seen one 5 minutes high, and that was faint and wholly detached like a little cloud.

The depth of the stratum of hydrogen, called the chromosphere, is 4" or 5" at the poles, and increases to 7" or 8" in the equatorial regions, where its surface is generally much disturbed and dotted all over with little tongues which are really minute prominences.

The prominences seen at any instant may, of course, be very far from the true limb of the Sun. According to their height they are scattered over a zone of from 20° to 50° in breadth as seen from the Sun's centre.

In the observations that follow the two first columns require no explanation. The third is the angle of position measured from the north *point* of the disk towards the west. The next is the heliocentric latitude, and the fifth the measured height. In the case of groups the highest part is given, and the angles of position of the extremities. The *length* of a prominence is given in degrees of the limb. In every case the observation was carried all round unless there is a note to the contrary.

1872.	G.M.T. h m	Angle from North point. °	Lat. °	Height above Chrom. "	Notes.
Sept. 5	5 30	85	+ 28	15	Fig. 2* very bright.
	to	110	+ 3	..	Small low prominences from 80° to 140°.
	6 20	260	- 33	16	Fig. 1; very bright; cloudlike.
5	20 0	100	+ 23	..	Long low prominence, with chromosphere much disturbed for 12° or 14° on either side of it.
	to	280	- 13	15	Fig. 3; bright; observation interrupted by cloud.
6	5 30	280	- 13	30	Fig. 4; cloud-like, same as fig. 3. No other part of disk examined.
8	5 15	99	+ 14	..	Detached; cloud-like.
	5 20	279	- 14	20	Bright; partly detached; fig. 5, same as fig. 3. From 120° to 250° not examined.
11	5 30	88	+ 26	..	Bright; not large; angular in outline.
		279	- 15	..	Chromosphere much disturbed for 20°. 300° to 360° not examined.
12	4 45	73	+ 41	30	
	to	98	+ 16	15	
	5 20	153	- 31	50	Fig. 6; intensely bright.
		173	- 59	60	Fig. 7; ,, ,,
		263	- 31	30	Fig. 5a.
16	4 30	82	+ 32	30	Double; cloud-like. Fig. 8.
		135	- 21	..	Chromosphere much disturbed.
		337	+ 43	70	Fig. 9.
19	4 30	62	+ 53	15	
	to	82	+ 33	25	Bright; fig. 10. Small one near.
	5 15	147	- 32	22	Fine group; very brilliant. Fig. 11.
	to	167	- 52		
		237	- 25	50	Huge mass occupying some 30° of the limb; ill-defined above; patches of different intensity.
	to	270	- 58		
21	18 35	137	- 22	50	Very bright. Fig. 13.
	to	262	- 33	30	Double, something like fig. 12; bright clearly defined. The tops curve towards each other, and, I think, meet
	18 50	292	- 3	..	Small; bright; pointed.
		337	+ 42	40	{ Bright; double; fig 12. Apparently unconnected with it a tall faint pillar-like mass. 25 minutes later the bright horizontal portions had completely disappeared.
		339	+ 44	90	
		352	+ 57	30	Roughly square figure.

* The figures were exhibited at the Meeting, and can be seen at the Society's rooms.

1872.	G.M.T.	Angle from North point.	Lat.	Height above Chrom.	Notes.
	^h ^m	[°]	[°]	'	
Sept. 22	4 15	87	+ 28	..	Small p.
	to	112	+ 3	55	Much diffused; overhanging to left.
	5 15				
		132	-17	50	Double; diffused; partly pointed.
		254	-41	75	Much diffused; 13° long; a huge mass.
		267	-28		
		to	to	25	Brilliant arches. Fig. 15.
		282	-13		
		335	+40	60	Fig. 14. Same as fig. 12 of yesterday.
		339	+44	130	
		307	+12	15	
		352	+57	20	
26	4 0	59	+57	10	Number of small ones.
	to	69	+49	15	Bright; diffused edges.
	4 20	79	+37	10	Faint.
		89	+27	..	Some very small ones.
		113	+ 3	290	Very far detached.
		119	- 3	..	Some very small ones; detached one over.
		145	-29		
		to	to	..	Mass; very bright; length 6°.
		150	-34		
		174	-58	..	Small.
		249	-47	..	Small.
		260	-36		
		270	-26	15	Double; bright.
29	2 30	91	+25	..	Very small.
	to	99	+17	20	Very bright; curved far to right.
	3 0	112	+ 4	30	Bright; overhangs at either end.
		128	-12	45	Brilliant jet, curved over to left. Two very bright narrow straight jets to right.
		159	-43	15	Group.
		167	-51	45	Two sharply pointed; left hand one 30°. Examined from 20° to 195°; Cloudy.
Oct. 3	3 45	67	+49		
	to	to	to	140	Group of three; very fine.
	4 35	83	+33		
		95	+21	40	Small.
		115	+ 1	60	Small.
		130	-14	60	Long, low, suspended jet; very bright.
		165	-49	70	Diffused. Examined from 20° to 180°.

		G.M.T.	Angle from North point.	Lat.	Height above Chrom.	Notes.
		^h ^m	^o	^o	["]	
1872.	Oct. 4	3 0	64	+ 52	40	Faint; diffused.
		to	94	+ 22	22	Diffused.
		4 40	111	+ 5	22	Faint.
			121	- 5	15	Small.
			132	-16	53	Rich group; an hour later scarcely anything remained of this group.
			154	-38	35	Diffused; chromosphere much disturbed on either side.
			243	- 53	40	Fine group.
			to	to		
			258	-38		
			267	-29	25	Double.
			273	-23	25	Diffused.
			291	- 5	15	Small, but remarkably bright at 3.55. Totally disapp. by 4.30.
			321	+ 25	55	Large arch.
			to	to		
			329	+ 33		
6	2 10		64	+ 52	27	Pointed; bright; little ones on either side.
	to		80	+ 36		Three small ones.
	3 40		95	+ 21	35	Cloud-like; suspended.
			to	to		
			107	+ 9		
			122	- 6	..	Beautiful group of jets. Fig. 18.
			129	-13	35	Long and low. Fig. 18.
			to	to		
			137	-21		
			163	-47	45	4° long; top double.
			276	-20	60	Brilliant. Fig. 19; 40 ^m later 100 ["] .
			282	-14	50	Very brilliant. Fig. 19 a.
			293	- 3	30	Fine curved jet. Fig. 17.
			299	+ 3	10	Pointed.
			311	+15	45	An extremely brilliant jet that appeared and disappeared in 15 ^m . Fig. 20.
			303	+ 7	..	Group with brilliant jets 15 to 30 ["] . Fig. 20.
			to	to		
			320	+ 24		
7	3 5		70	+46	60	Length 3°.
	to		80	+ 36	30	Long and low, occupying 7° of limb.
	4 0					
			120	- 4	..	Several very small ones.
			165	-49	30	Small.

1872.	G.M.T.	Angle from North point.	Lat.	Height above Chrom.	Notes.
	^h ^m	^o	^o	["]	
Oct. 7	3 5	272	-24	88	Fig. 21.
	to	282	-14	62	
	4 0	290	-6		
		to	to	20	Arborescent groups.
		301	+5		
		312	+16	22	Pointed; many small ones to left.
		320	+24	12	Small and bright.
		349	+53	..	Small and faint.
	3 10	72	+44	65	Bright; diffused edges.
	to	78	+38		
	4 0	to	to	30	Group.
		90	+26		
		84	+32	90?	High detached cloud; faint.
		97	+19	20	Fine straight jet.
		111	+5		
		to	to	..	Chromosphere much disturbed.
		126	-10		
		132	-16	12	Very small.
		138	-22		
		to	to	48	Fine group, mostly suspended.
		147	-31		
		182	-66	..	Chrom. much disturbed for 15°.
		246	-50	15	Double.
		266	-30	51	Arborescent.
		294	-2	92	Detached over low bright one. Fig. 22.
		299	+3		Group suspended, aurora-like. Fig. 22.
		to	to	150	
		305	+9		
		314	+18	35	Very, very bright; bluntly pointed.
		317	+2	30	Faint curved jet.
11	1 20	88	+28		Row of low diffused ones.
	to	to	to	50	
	2 5	111	+5		
		152	-36	88	Large; 6° long; cloud-like.
		259	-37	34	Diffused; large.
		268	-28	26	Large.
		288	-8	20	Small; pointed.
		293	-3		Beautiful group.
		to	to	56	
		304	+8		

	G.M.T.	Angle from North point.	Lat.	Height above Chrom.	Notes.
	^h ^m	°	°	"	
1872. Oct. 14	2 40	67	+ 49	15	Very faint; small; eruption of chromosphere.
	to	98	+ 18	15	3° long.
	4 0	134	- 18	34	4° long; arborescent.
		144	- 28	12	Small group.
		242	- 54	30	Faint; diffused.
		269	- 27	10	Very small; bright.
		283	- 14	10	Bright jet.
		301	+ 5	15	Pointed; base 1°.
		310	+ 14	26	Bright; rectangular; breadth 12".
		317	+ 20	30	Very bright; arborescent. 45 ^m later this prominence was united to the next by a curved jet.
		323	+ 26	15	Faint group.
		339	+ 43	15	Arborescent; diffused.
		343	+ 46	15	Arborescent; diffused.
		to	to		
		355	+ 58	..	Chromosphere much disturbed.
15	4 13	72	+ 45	50	5° long; massive.
	4 15	83	+ 34	15	2° long.
	4 17	96	+ 21	12	Bright.
	4 19	139	- 23	20	Faint.
	4 20	146	- 30	20	Faint.
	4 21	153	- 36	12	Chromosphere disturbed; small bright oblique jet at 153°.
		to	to		
		158	- 41		
	4 22	174	- 57	12	Group of small ones.
	4 28	257	- 40	130	Very, very bright; 4° long; ar- borescent; rectangular.
	4 31	299	+ 3	15	Jet; curved; irregular; faint.
	4 33	318	+ 22	30	Bright; arborescent; 5° long.
	4 34	326	+ 30	30	Very bright; rectangular.
		331	+ 35	30	Oblique jet; joining preceding.
	4 38	347	+ 51	20	Faint.
16	3 17	73	+ 44	45	Bright; arborescent.
	3 23	128	- 12	15	Very, very bright; faint cloud over, 40".
	3 25	135	- 19	15	Very, very bright.
	3 27	141	- 24	22	Continuous mass.
		to	to		
		149	- 33		
	3 35	153	- 37	25	Beautiful arborescent group.
		to	to		
		168	- 52		

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1872.	G.M.T.	Angle from North point.	Lat.	Height above Chrom.	Notes.
	^h ^m	^o	^o	^o	
Oct. 16	3 37	173	-57	..	Chromosphere much disturbed. Examined from 20° to 212°.
		to	to		
		202	-86		
23	3 20	67	+49	10	Chromosphere disturbed.
	3 23	110	+ 6	95	Very fine; wholly suspended; ar- borescent.
	3 28	125	- 9	13	Group, 5° long.
		to	to		
		130	-14		
	3 35	137	-21	13	3° long.
	3 40	247	-48	150	Bright pyramidal mass; many jets.
		to	to		
		258	-38		
23	3 44	264	-32	20	Faint curved jet, 3° long.
	3 47	277	-19	30	Very bright; 5° long.
	3 50	287	- 9	10	3° long; bright.
	3 51	294	- 2	12	3° long. The chrom. is much dis- turbed from 260° round to 320°.
	3 54	320	+24	12	Small bright point.
	3 56	324	+28	19	3° long; faint.
28	2 42	68	+47	15	Chromosphere disturbed; low, faint prominences for 5°.
	2 46	85	+30	15	Long row, very bright, 15" to 20" high; at 107° a high curved jet.
		to	to		
		107	+ 8	70	
	2 52	123	- 8	10	Chromosphere much disturbed; little bright jet at 123°.
		to	to		
		148	-32	..	
	2 55	158	-43	30	Length 2°.
	2 57	201	-86	..	Chromosphere disturbed; faint prominences at 207°.
		207	-88	12	
	3 2	244	-52	34	Faint; 2° long.
	3 10	324	+29	35	Fine group with jets.
		331	+36		
Nov. 3	3 37	89	+25	60	Bright mass; suspended.
		to	to		
		98	+16		
	3 39	112	+ 3	20	Faint; 3° long.
	3 42	133	-19	10	Chromosphere much disturbed.
		to	to		
		143	-29		
	3 44	149	-35	42	Bright; 4° long; pointed.
	3 48	242	-54	13	Bright; 3° long.

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1872.	G.M.T. h m	Angle from North point. °	Lat. °	Height above Chrom. "	Notes.
Nov. 3	3 50	247	-48	31	Bright mass.
		to	to		
		253	-42		
	3 56	265	-30	34	Very bright, flat mass.
		to	to		
		280	-15		
	4 0	286	-8	35	Large faint arch, with low, bright prominence under it.
	to	to	to		
	4 10	302	+8		
		306	+12	25	Very bright, pointed and curved, 5° long.
		316	+22	15	Very bright; flat. From 286 to 319 is a continuous group.
7	1 50	47	+66	10	Very faint; 2° long.
	1 53	85	+28	..	Chromosphere much disturbed.
		to	to	..	
		115	-2	..	
	1 56	139	-26	20	Faint; 3° long.
	1 57	145	-32	25	Bright; 3° long.
	1 59	160	-47	10	Very faint.
		to	to		
		167	-54		
	2 6	267	-26	22	Very bright; 4° long.
	2 8	276	-17	20	Very bright group.
		to	to		
		284	-9		
	2 14	317	+23	10	Small bright jet. Very fine definition. The limb of the Sun is singularly free from prominences. On the disk is a chain of large spots, all approximately in latitude -20°.
11	2 23	67	+46	110	Beautiful arborescent group; highest at 76°.
		to	to		
		83	+30		
	2 31	114	-1	62	Detached cloud; faint.
	2 45	263	-30	28	Bright; roughly square figure.
	2 52	301	+9	110	Bright; tall; pointed; nearly perpendicular.
	2 57	309	+15	56	Beautiful group with arched jets; very bright; in three masses.
		to	to	40	
		321	+27		
	3 3	334	+42	15	Very faint; 3° long.
	3 4	349	+56	22	Bright; 3° long.
14	2 39	62	+49	26	Very bright; 4° long. Group.

1872.	G.M.T. h m	Angle from North point. °	Lat. °	Height above Chrom. "	Notes.
Nov. 14	2 42	69	+ 43	56	Very bright; rectangular. Group.
		to	to		
		74	+ 38		
	2 45	101	+ 11	12	Group of low, bright prominences, or disturbed chromosphere.
		to	to		
		115	— 3		
	2 51	148	— 36	12	Long faint group of three.
		161	— 49		
		264	— 28		
	3 5	264	— 28	19	Very, very bright; double; 5° or 6° long.
		270	— 22		
		290	— 2		
	3 11	270	— 22	..	Chromosphere much disturbed.
		290	— 2		
		279	— 12		
	3 33	279	— 12	17	Very, very bright; 2° long; connected with the preceding by disturbed chromosphere.
		294	+ 3		
		327	+ 35		
	3 36	294	+ 3	15	Very faint; 2° long.
		327	+ 35		
		337	+ 45		
	3 39	327	+ 35	70	Beautiful arborescent group in three bright masses with arched jets connecting them.
		337	+ 45		

*On the Circumstances of the Transit of Venus, 1874, Dec. 8,
at Port Louis, Mauritius. By Mr. Hind.*

As important expeditions will proceed from England and Germany to the Mauritius for the observation of this phenomenon, the following particulars of the circumstance for Port Louis in that island may possess interest. I have adopted the longitude and latitude discussed in the Appendix to the *Connaissance des Temps* for 1845, and since continued in the table annually published with that work, viz. (with telegraphic differences of longitudes between Greenwich and Paris), longitude 3^h 50^m 8^s.6 east, latitude 20° 9' 45" south. The data of the *Nautical Almanac* are employed in their entirety.

	Local Sidereal Time.			Local Mean Time.			Angles for direct Image.		Sun's True Altitude.		Sun's True Hour Angle.		
	h	m	s	h	m	s	N. Point.	Vertex.	°	'	h	m	s
1st Ext. Cont.	10	56	30	17	45	55	48° 2' E	157° 3' E	6	16	— 6	6	28
1st Int. "	11	26	58	18	16	18	41° 9' E	148° 5' E	12	55	— 5	36	6
2nd Int. "	15	0	24	21	49	10	346° 2' E	76° 6' E	61	15	— 2	3	18
2nd Ext. "	15	30	2	22	18	43	340° 0' E	67° 1' E	68	3	— 1	33	45

The middle of the transit at 20^h 3^m 9^s mean time, or 13^h 14^m 6 sidereal time, with the Sun 3^h 49^m 17^s east of the meridian at an altitude of 36° 56'. The nearest approach of centres 13' 54" or 0.8548 of the Sun's radius. The Sun rises at Port Louis at 17^h 13^m.